

Lecture 18 - The Magnetic Field of a Current

Chapter 33 - Thursday March 22nd

- Review of the magnetic field of a current
- Use of the *Biot-Savart* law
- A reminder about electrostatics and Gauss' law
- Some more vector calculus
- Ampère's law

Reading: pages 749 thru 765 (up end of Ch. 33) in HRK

Read and understand the sample problems

WebAssign deadline will be Monday 26th at 11:59pm

Homework set (Ch. 33): E12, E22, E24, E28, E32, E35

Practice problems from the text:

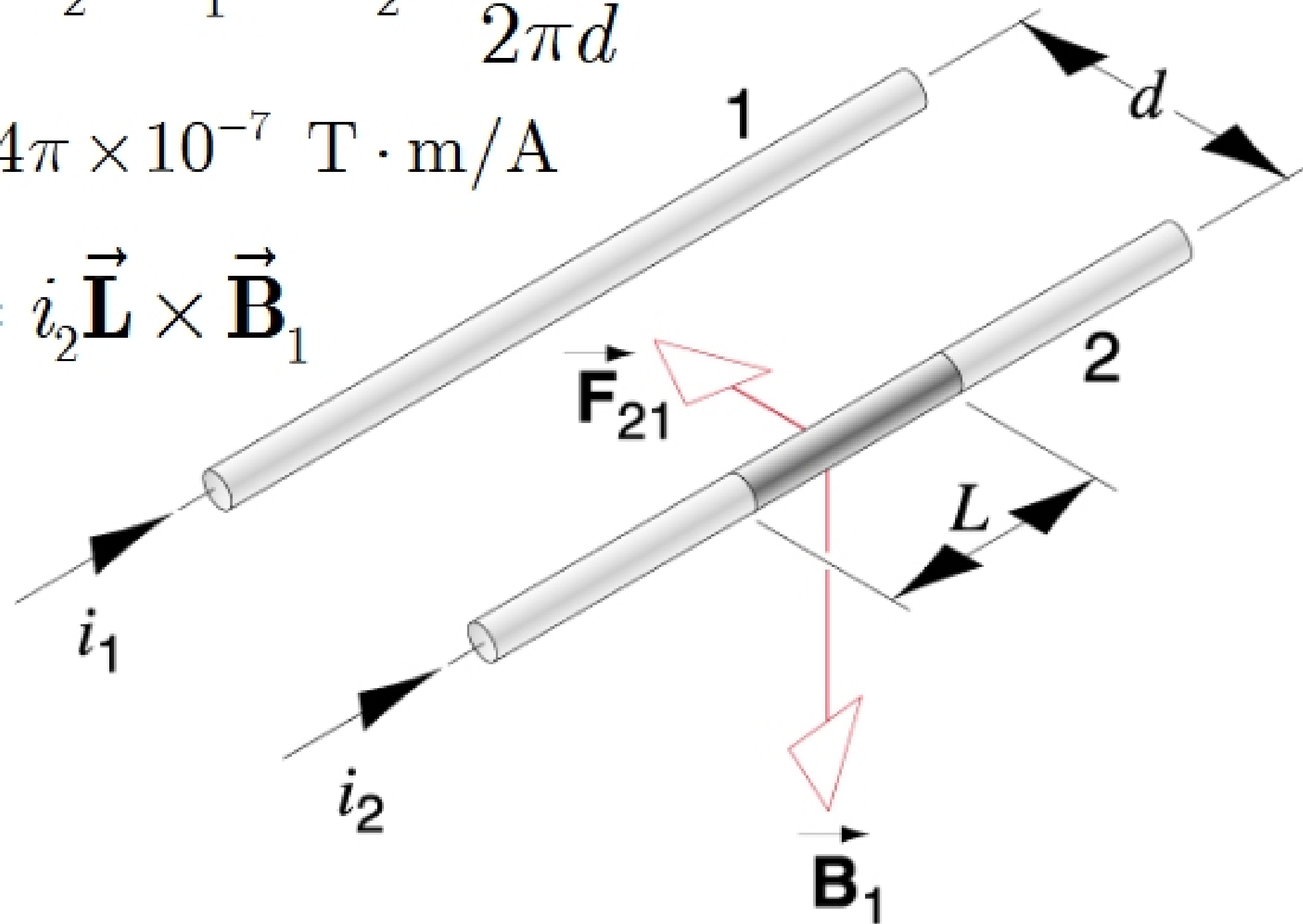
Ch. 33 - Ex. 27, 33, 37; Prob. 13

The magnetic force between two wires

$$F_{21} = i_2 L B_1 = i_2 L \frac{\mu_0 i_1}{2\pi d}$$

$$\mu_0 = 4\pi \times 10^{-7} \text{ T} \cdot \text{m/A}$$

$$\vec{F}_{21} = i_2 \vec{L} \times \vec{B}_1$$



μ_0 chosen so that when $i_1 = i_2 = 1 \text{ A}$, and $L = d = 1 \text{ m}$, $F_{21} = 2 \times 10^{-7} \text{ N}$

The magnetic field due to a wire in 3D

$$B = \frac{\mu_0 i}{2\pi r}$$

Like Coulomb's Law:
(For an infinite line charge)

$$E = \frac{\lambda}{2\pi\epsilon_0 r}$$

$$q \rightarrow ids \text{ or } vq$$

$$\frac{1}{\epsilon_0} \rightarrow \mu_0 \quad \lambda = \frac{dq}{ds} \rightarrow i$$

